ANNEX L
to
MARS CORRECT: Critique of all NASA Mars Weather Data, With Emphasis on Pressure

VARIATION OF DAYLIGHT DUE TO CHANGE OF LATITUDE AND SOLAR LONGITUDE (LS)

TABLE 10A Mars Science Laboratory Curiosity Rover	**λsun**	**Latitude (phi) at MSL**	**δdegrees = arcsin((sin(25.19)*sin(λsun))**	**H = arccos((SIN(-.17) - SIN(lw)*SIN(δ))/(COS(lw)*COS(δ)))**	**Daylight= 2*1.027491*H/360**	**Daylight In Earth Hours David Roffman's Calculation (=E value * 24)**
Fall	**0**	**-4.59**	**0**	**90.17054697**	**0.51471903**	**12.35325673**
	30	**-4.59**	**12.28711642**	**89.17267137**	**0.509022874**	**12.21654897**
	60	**-4.59**	**21.62923453**	**88.35931782**	**0.504380021**	**12.10512051**
Winter	**90**	**-4.59**	**25.19**	**88.02453664**	**0.502468995**	**12.05925589**
	120	**-4.59**	**21.62923453**	**88.35931782**	**0.504380021**	**12.10512051**
Minimum Pressure	**145**	**-4.59**	**14.13021166**	**89.0178399**	**0.508139052**	**12.19533724**
	150	**-4.59**	**12.28711642**	**89.17267137**	**0.509022874**	**12.21654897**
spring	**180**	**-4.59**	**2.98768E-15**	**90.17054697**	**0.51471903**	**12.35325673**
	210	**-4.59**	**-12.28711642**	**91.17647243**	**0.520461138**	**12.49106731**
	240	**-4.59**	**-21.62923453**	**92.00779835**	**0.525206582**	**12.60495796**
Summer	**270**	**-4.59**	**-25.19**	**92.35267298**	**0.527175224**	**12.65220537**
	300	**-4.59**	**-21.62923453**	**92.00779835**	**0.525206582**	**12.60495796**
	330	**-4.59**	**-12.28711642**	**91.17647243**	**0.520461138**	**12.49106731**

TABLE 10B VIKING 1	λsun	Latitude (phi) at Viking 1	δdegrees = arcsin((sin(25.19)*sin(λsun))	H = arccos((SIN(-.17) - SIN(lw)*SIN(δ))/(COS(lw)*COS(δ)))	Daylight= 2*1.027491*H/360	Daylight In Earth Hours David Roffman's Calculation (=E value * 24)
spring	0	22.48	0	90.18398013	0.514795711	12.35509706
	30	22.48	12.28711642	95.35997789	0.544341772	13.06420254
	60	22.48	21.62923453	99.64455384	0.568799346	13.6511843
summer	90	22.48	25.19	101.4306674	0.578994988	13.89587972
	120	22.48	21.62923453	99.64455384	0.568799346	13.6511843
minimum Press.	145	22.48	14.13021166	96.17028682	0.548967245	13.17521389
	150	22.48	12.28711642	95.35997789	0.544341772	13.06420254
fall	180	22.48	2.98768E-15	90.18398013	0.514795711	12.35509706
	210	22.48	-12.28711642	85.01814757	0.485307675	11.6473842
	240	22.48	-21.62923453	80.75671616	0.460982217	11.06357321
winter	270	22.48	-25.19	78.98389113	0.450862429	10.8206983
	300	22.48	-21.62923453	80.75671616	0.460982217	11.06357321
	330	22.48	-12.28711642	85.01814757	0.485307675	11.6473842

TABLE 10C VIKING 2	λsun	Latitude (phi) at Viking 2	δdegrees = arcsin((sin(25.19)*sin(λsun))	H = arccos((SIN(-.17) - SIN(lw)*SIN(δ))/(COS(lw)*COS(δ)))	Daylight= 2*1.027491*H/360	Daylight In Earth Hours David Roffman's Calculation (=E value * 24)
spring	0	47.97	0	90.25391385	0.515194912	12.36467789
	30	47.97	12.28711642	104.2511089	0.595094868	14.28227682
	60	47.97	21.62923453	116.4030014	0.664461313	15.94707151
summer	90	47.97	25.19	121.7844733	0.695180279	16.6843267
	120	47.97	21.62923453	116.4030014	0.664461313	15.94707151
minimum Press.	145	47.97	14.13021166	106.4910096	0.607880855	14.58914053
	150	47.97	12.28711642	104.2511089	0.595094868	14.28227682
fall	180	47.97	2.98768E-15	90.25391385	0.515194912	12.36467789
	210	47.97	-12.28711642	76.28449627	0.435453519	10.45088445
	240	47.97	-21.62923453	64.20531886	0.366502152	8.796051637
winter	270	47.97	-25.19	58.87340259	0.336066063	8.065585506
	300	47.97	-21.62923453	64.20531886	0.366502152	8.796051637
	330	47.97	-12.28711642	76.28449627	0.435453519	10.45088445

TABLE 10D PHOENIX	λsun	Latitude (phi) at Phoenix	δdegrees = arcsin((sin(25.19)*sin(λsun))	H = arccos((SIN(-.17) - SIN(lw)*SIN(δ))/(COS(lw)*COS(δ)))	Daylight= 2*1.027491*H/360	Daylight In Earth Hours David Roffman's Calculation (=E value * 24)
May 5 2008 landing	76.6	68	24.45850987	No sunset	No sunset	No sunset
summer solstice	90	68	25.19	No sunset	No sunset	No sunset
8/28/2008 1st sunset	119.115	68	21.82925823	179.5055976	1.024668811	24.59205146
	145	68	14.13021166	129.1427046	0.737183149	17.69239557
Signal loss day	151	68	11.90826481	122.0088441	0.696461051	16.71506523
First Ls of no sunrise (Phoenix not operational)	242.45	68	-22.17019556	No sunrise	No sunrise	No sunrise
First Ls of no sunset (Phoenix not operational)	60.89	68	21.83037359	No sunset	No sunset	No sunset

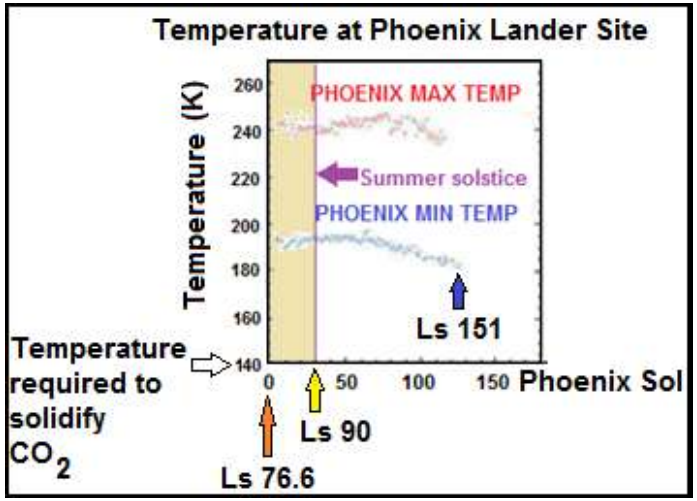

Figure 1 - Temperatures Recorded by Phoenix (adapted from Nelli et al, 2009).

ACCURACY CHECKS FOR THE LATITUDES CLOSE TO OR AT THE ANTARCTIC CIRCLE (64.81° South)

The tables below look at accuracy for our method determining number of hours of daylight on Mars. Specifically, we focus on both sides of the Antarctic Circle at 64.81° South. If our method were perfect and if Mars was a perfect sphere, then we would expect that at the southern winter solstice at Ls 90 the Antarctic Circle would see no sunrise, and at the southern hemisphere summer solstice there would be no sunrise. However, the chart does not show total darkness for winter solstice until 64.98° South (see Table 10J), which is 0.18° of latitude further south than expected. One degree of latitude difference on Mars is about 59 km, so a 0.18° error translates to about 10.62 km (5.73 nautical miles). The error likely occurs due to rounding off the axial tilt to two decimal places at 25.19°.

Table 10E				Daylight=	Daylight
Λsun	Latitude	δdegrees =	H = arccos((SIN(-.17) - SIN(lw)*SIN(δ))/(COS(lw)*COS(δ)))	2*1.027491*H/360	In Hours
(0 for spring	(phi)	arcsin((sin(25.19)*sin(λsun))			David's
in northern					Calculation
hemisphere)					(=E value * 24)
240	-60	-21.62923453	133.8818484	0.764235524	18.34165257
250	-60	-23.57525619	139.6672305	0.797260124	19.13424297
260	-60	-24.78126436	143.7232658	0.820413123	19.68991495
270	-60	-25.19	145.2080894	0.828888917	19.893334
280	-60	-24.78126436	143.7232658	0.820413123	19.68991495
290	-60	-23.57525619	139.6672305	0.797260124	19.13424297
60	-60	21.62923453	47.12459579	0.269000545	6.456013073
70	-60	23.57525619	41.46595813	0.236699438	5.680786505
80	-60	24.78126436	37.52415236	0.214198494	5.140763845
85	-60	25.08749348	36.45356563	0.208087281	4.994094747
90	-60	25.19	36.08790032	0.20599996	4.943999038
95	-60	25.08749348	36.45356563	0.208087281	4.994094747
100	-60	24.78126436	37.52415236	0.214198494	5.140763845
110	-60	23.57525619	41.46595813	0.236699438	5.680786505
120	-60	21.62923453	47.12459579	0.269000545	6.456013073

Table 10F					Daylight
λsun	Latitude	δdegrees =	H = arccos((SIN(-.17) - SIN(lw)*SIN(δ))/(COS(lw)*COS(δ)))	Daylight=	In Hours
(0 for spring	(phi)	arcsin((sin(25.19)*sin(λsun))		2*1.027491*H/360	David's
in northern					Calculation
hemisphere)					(=E value * 24)
240	-64.5	-21.62923453	147.0064607	0.83915453	20.13970871
250	-64.5	-23.57525619	157.2793431	0.897795053	21.54708127
260	-64.5	-24.78126436	167.290554	0.954941881	22.91860515
265	-64.5	-25.08749348	171.5500603	0.97925635	23.5021524
270	-64.5	-25.19	173.5794411	0.99084063	23.78017513
275	-64.5	-25.08749348	171.5500603	0.97925635	23.5021524
280	-64.5	-24.78126436	167.290554	0.954941881	22.91860515
290	-64.5	-23.57525619	157.2793431	0.897795053	21.54708127
35	-64.5	14.13021166	58.62187068	0.334630247	8.031125938
40	-64.5	15.87765582	53.90208229	0.307688358	7.384520591
50	-64.5	19.02889074	44.29200084	0.25283129	6.067950965
60	-64.5	21.62923453	34.52246478	0.19706401	4.729536248
70	-64.5	23.57525619	24.85699306	0.141890759	3.405378221
80	-64.5	24.78126436	16.1953387	0.092447582	2.218741967
85	-64.5	25.08749348	13.11289008	0.074852092	1.796450205
90	-64.5	25.19	11.90377492	0.06795012	1.630802879
95	-64.5	25.08749348	13.11289008	0.074852092	1.796450205
100	-64.5	24.78126436	16.1953387	0.092447582	2.218741967
110	-64.5	23.57525619	24.85699306	0.141890759	3.405378221
120	-64.5	21.62923453	34.52246478	0.19706401	4.729536248
130	-64.5	19.02889074	44.29200084	0.25283129	6.067950965
140	-64.5	15.87765582	53.90208229	0.307688358	7.384520591
145	-64.5	14.13021166	58.62187068	0.334630247	8.031125938

Table 10G					Daylight
λsun	Latitude	δdegrees =	H = arccos((SIN(-.17) - SIN(lw)*SIN(δ))/(COS(lw)*COS(δ)))	Daylight=	In Hours
(0 for spring	(phi)	arcsin((sin(25.19)*sin(λsun))		2*1.027491*H/360	David's
in northern					Calculation
hemisphere)					(=E value * 24)
240	-64.7	-21.62923453	147.8125349	0.84375583	20.25013991
250	-64.7	-23.57525619	158.549463	0.905045257	21.72108617
260	-64.7	-24.78126436	169.8381862	0.969484488	23.26762771
265	-64.7	-25.08749348	176.4519194	1.007237551	24.17370121
270	-64.7	-25.19	NO SUNSET	NO SUNSET	NO SUNSET
275	-64.7	-25.08749348	176.4519194	1.007237551	24.17370121
280	-64.7	-24.78126436	169.8381862	0.969484488	23.26762771
290	-64.7	-23.57525619	158.549463	0.905045257	21.72108617
60	-64.7	21.62923453	33.76002531	0.19271179	4.625082955
70	-64.7	23.57525619	23.71126491	0.135350618	3.248414839
80	-64.7	24.78126436	14.29912876	0.081623478	1.958963481
85	-64.7	25.08749348	10.65719175	0.06083427	1.460022481
90	-64.7	25.19	9.118366105	0.052050217	1.249205214
95	-64.7	25.08749348	10.65719175	0.06083427	1.460022481
100	-64.7	24.78126436	14.29912876	0.081623478	1.958963481
110	-64.7	23.57525619	23.71126491	0.135350618	3.248414839
120	-64.7	21.62923453	33.76002531	0.19271179	4.625082955

Table 10H				Daylight=	Daylight
λsun	Latitude		H = arccos((SIN(-.17) - SIN(lw)*SIN(δ))/(COS(lw)*COS(δ)))	2*1.027491*H/360	In Hours
(0 for spring	(phi)	δdegrees =			David's
in northern		arcsin((sin(25.19)*sin(λsun))			Calculation
hemisphere)					(=E value * 24)
240	-64.81	-21.62923453	148.2688624	0.846360676	20.31265623
250	-64.81	-23.57525619	159.2880723	0.909261449	21.82227476
260	-64.81	-24.78126436	171.5785124	0.979418763	23.5060503
265	-64.81	-25.08749348	NO SUNSET	NO SUNSET	NO SUNSET
270	-64.81	-25.19	NO SUNSET	NO SUNSET	NO SUNSET
275	-64.81	-25.08749348	NO SUNSET	NO SUNSET	NO SUNSET
280	-64.81	-24.78126436	171.5785124	0.979418763	23.5060503
290	-64.81	-23.57525619	159.2880723	0.909261449	21.82227476
60	-64.81	21.62923453	33.32923304	0.190252705	4.566064932
70	-64.81	23.57525619	23.05072897	0.131580092	3.157922208
80	-64.81	24.78126436	13.12899215	0.074944007	1.79865617
85	-64.81	25.08749348	9.009847648	0.051430763	1.234338316
90	-64.81	25.19	7.116514369	0.04062308	0.974953929
95	-64.81	25.08749348	9.009847648	0.051430763	1.234338316
100	-64.81	24.78126436	13.12899215	0.074944007	1.79865617
110	-64.81	23.57525619	23.05072897	0.131580092	3.157922208
120	-64.81	21.62923453	33.32923304	0.190252705	4.566064932

Table 10I				Daylight=	Daylight
λsun	Latitude		H = arccos((SIN(-.17) - SIN(lw)*SIN(δ))/(COS(lw)*COS(δ)))	2*1.027491*H/360	In Hours
(0 for spring	(phi)	δdegrees =			David's
in northern		arcsin((sin(25.19)*sin(λsun))			Calculation
hemisphere)					(=E value * 24)
240	-64.97	-21.62923453	148.9501851	0.850249859	20.40599662
250	-64.97	-23.57525619	160.4214389	0.915731026	21.97754463
260	-64.97	-24.78126436	175.1521431	0.999818059	23.99563343
265	-64.97	-25.08749348	NO SUNSET	NO SUNSET	NO SUNSET
270	-64.97	-25.19	NO SUNSET	NO SUNSET	NO SUNSET
275	-64.97	-25.08749348	NO SUNSET	NO SUNSET	NO SUNSET
280	-64.97	-24.78126436	175.1521431	0.999818059	23.99563343
290	-64.97	-23.57525619	160.4214389	0.915731026	21.97754463
60	-64.97	21.62923453	32.68721959	0.186587911	4.478109859
70	-64.97	23.57525619	22.04641079	0.125847159	3.020331822
80	-64.97	24.78126436	11.19428666	0.06390016	1.533603839
85	-64.97	25.08749348	5.802960511	0.033124943	0.794998627
90	-64.97	25.19	1.73010916	0.009875953	0.237022879
95	-64.97	25.08749348	5.802960511	0.033124943	0.794998627
100	-64.97	24.78126436	11.19428666	0.06390016	1.533603839
110	-64.97	23.57525619	22.04641079	0.125847159	3.020331822
120	-64.97	21.62923453	32.68721959	0.186587911	4.478109859

Table 10J				Daylight=	Daylight
λsun	Latitude		H = arccos((SIN(-.17) - SIN(lw)*SIN(δ))/(COS(lw)*COS(δ)))	2*1.027491*H/360	In Hours
(0 for spring	(phi)	δdegrees =			David's
in northern		arcsin((sin(25.19)*sin(λsun))			Calculation
hemisphere)					(=E value * 24)
240	-64.98	-21.62923453	148.9934879	0.850497044	20.41192905
250	-64.98	-23.57525619	160.4948346	0.91614999	21.98759975
260	-64.98	-24.78126436	175.4697733	1.001631183	24.03914839
265	-64.98	-25.08749348	NO SUNSET	NO SUNSET	NO SUNSET
270	-64.98	-25.19	NO SUNSET	NO SUNSET	NO SUNSET
275	-64.98	-25.08749348	NO SUNSET	NO SUNSET	NO SUNSET
280	-64.98	-24.78126436	175.4697733	1.001631183	24.03914839
290	-64.98	-23.57525619	160.4948346	0.91614999	21.98759975
60	-64.98	21.62923453	32.64646468	0.18635527	4.472526486
70	-64.98	23.57525619	21.98178853	0.125478277	3.011478651
80	-64.98	24.78126436	11.06146444	0.063141973	1.515407355
85	-64.98	25.08749348	5.539890915	0.031623267	0.758958407
90	-64.98	25.19	NO SUNRISE	NO SUNRISE	NO SUNRISE
95	-64.98	25.08749348	5.539890915	0.031623267	0.758958407
100	-64.98	24.78126436	11.06146444	0.063141973	1.515407355
110	-64.98	23.57525619	21.98178853	0.125478277	3.011478651
120	-64.98	21.62923453	32.64646468	0.18635527	4.472526486